

CLAIMS

1 *Sub* 1. A control apparatus for a single or multiple plug-dropping tool,
2 comprising:
3 at least one signal transmitter for sending at least one signal over
4 the air;
5 at least one signal receiver on a body for receiving said signal
6 from said transmitter and to provide an output;
7 at least one control system comprising a primary control element;
8 at least one signal processor to use said output from said re-
9 ceiver to selectively remotely operate said primary control element to allow
10 release of a plug from the apparatus by said system;
11 at least one final control element, said final control element
12 selectively preventing and allowing a plug to drop from the apparatus, where-
13 upon actuation of said primary control element selectively permits actuation
14 of said final control element to drop a plug;
15 said primary control element further comprising:
16 a driver; and
17 a transmission operably engaged to said final control element to
18 selectively move said final control element so that said plug can be retained
19 or released.

1 2. The apparatus of claim 1, wherein:
2 said control system operates off a power source mounted in said
3 body; and

a 4 ^{motor} said driver is mounted in said body and powered by said power
5 source.

1 3. The apparatus of claim 2, wherein:
2 said driver is enclosed in a sealed chamber in said body which
3 is pressurized by an inert fluid.

a 1 4. The apparatus of claim ³~~2~~, wherein:
2 said power source comprises a battery; and
a 3 said battery is mounted in said chamber with said ^{driver}~~motor~~.

1 5. The apparatus of claim ⁵~~1~~, further comprising:
2 a clutch in said ²⁸~~transmission~~ to selectively disengage from said
3 final control element.

a 1 6. The apparatus of claim ⁵~~6~~, wherein:
2 said primary control element comprises a pin;
3 said final control element comprising a sleeve;
4 said pin engaging said sleeve to support it in a first position and
a 5 releasing said sleeve when said pin is moved a predetermined amount ^{to a second position}.

1 7. The apparatus of claim 6, wherein:
2 said pin has a beveled end;
3 said sleeve has a shoulder thereon;

4 said bevel in said pin engaging said shoulder on said sleeve in
5 said first position of said pin, said pin no longer extending into said shoulder
6 in its said second position.

1 8. The apparatus of claim 7, wherein:
2 said driver through said transmission rotates said pin between
3 said first and second positions.

1 9. The apparatus of claim 8, wherein:
2 said transmission is mechanically prevented from further rotation
3 as said second position is reached;
4 said control system sensing a stall condition in said driver by
5 measuring current draw to cut power to said driver.

1 10. The apparatus of claim 9, wherein:
2 said control system also cutting off power to said driver within a
3 predetermined time if said stall condition is not detected.

1 11. The apparatus of claim 6, wherein:
2 said transmission comprises at least one gear connected to said
3 pin that can be accessed from outside said body and moved out of contact
4 with its mating gear;
5 whereupon said pin can be manually returned to its said first
6 position.

1 *Sub*
2 *ar* 12. A plug-dropping apparatus for displacement of a material down
3 hole during the well drilling and completion operations by personnel working
4 on a rig, comprising:
5 at least one housing;
6 at least one plug selectively supportable within said housing;
7 at least one plug stop assembly on said housing selectively
8 operable to hold and release said plug;
9 at least one signal transmitter operable adjacent the rig and
10 remotely from said housing;
11 at least one signal receiver on said housing for receiving over the
12 air at least one signal from said transmitter;
13 at least one control system positioned at least in part in said
14 housing, said control system receiving an output from said signal receiver and
15 in response thereto actuating said plug stop to release said plug;
16 said control system further comprising:
17 a driver; and
18 a transmission operably engaged to said driver and said plug
19 stop assembly to selectively allow said plug stop assembly to move so that
said plug can be retained or released.

1 13. The apparatus of claim 12, wherein:
2 said control system operates off a power source mounted in said
3 *housing*
body; and
4 *motor* *housing*
said *driver* is mounted in said *body* and powered by said power
5 source.

1 14. The apparatus of claim 13, wherein:
2 said driver is enclosed in a sealed chamber in said body which
3 is pressurized by an inert fluid.

a 1 15. The apparatus of claim ~~14~~¹⁴, wherein:
2 said power source comprises a battery; and
3 said battery is mounted in said chamber with said motor.

1 16. The apparatus of claim 15, further comprising:
2 a clutch in said transmission to selectively disengage it from said
3 driver.

1 17. The apparatus of claim 16, wherein:
2 said transmission comprises a pin;
3 said plug stop assembly comprising a shoulder on a sleeve within
4 which said plug is selectively supported;
5 said pin engaging said shoulder to support said plug stop assem-
6 bly in a first position and releasing said shoulder when moved a predeter-
7 mined amount. ^{to a second position}

a 1 18. The apparatus of claim 17, wherein:
2 said pin has a beveled end;
3 said bevel in said pin engaging said shoulder on said sleeve in
4 said first position of said pin, said pin no longer extending into said shoulder
5 in its said second position.

1 19. The apparatus of claim 18, wherein:
2 said driver through said transmission rotates said pin between
3 said first and second positions.

1 20. The apparatus of claim 19, wherein:
2 said transmission is mechanically prevented from further rotation
3 as said second position is reached;
4 said control system sensing a stall condition in said driver by
5 measuring current draw to cut power to said driver.

1 21. The apparatus of claim 20, wherein:
2 said control system cutting off power to said driver within a
3 predetermined time if said stall condition is not detected.

1 22. The apparatus of claim 17, wherein:
2 said transmission comprises at least one gear connected to said
3 pin that can be accessed from outside said body and moved out of contact
4 with its mating gear;
5 whereupon said pin can be manually returned to its said first
6 position.

1 *Sub a3>* 23. A method of releasing balls or plugs for liner cementing, compris-
2 ing:
3 erecting an apparatus to drop balls or plugs on a casing or liner
4 string;

5 transmitting a signal over the air from a safe location to the
6 remotely mounted apparatus;
7 receiving said over-the-air signal at the apparatus;
8 using the signal received to trigger release of at least one ball or
9 plug;
10 using a sleeve to selectively support a ball or plug;
11 using a driver coupled to a transmission to selectively retain said
12 sleeve;
13 using said received signal to actuate said driver;
14 releasing said sleeve due to operation of said driver;
15 removing support for said ball or plug by movement of said
16 sleeve.

1 24. The method of claim 23, further comprising:
2 providing a beveled pin driven by said transmission;
3 rotating said pin from a first position where it supports said sleeve
4 to a second position where, due to said bevel, said pin no longer supports
5 said sleeve.

1 25. The method of claim 24, further comprising:
2 providing a clutching feature in said transmission to allow selec-
3 tive disconnection from said driver,
4 using a tool to engage said pin with said driver disconnected to
5 return it from said second to said first position.

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a 1 26. The method of claim 25, further comprising:
2 housing said driver in an enclosure pressurized with an inert fluid.

1 27. The method of claim 23, further comprising:
2 housing said driver in an enclosure pressurized with an inert fluid.

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